Remarks

Receipt is acknowledged of the Office Action mailed August 3, 2004. Claims 1-7 are pending. Claims 1, 3 and 4 have been amended. No new matter has been introduced. Thus, claims 1-7 are submitted for reconsideration at this time.

Applicants thank the Examiner for consideration of the priority documentation in the pending application.

In The Abstract

The Abstract stands objected to because lines 1-3 contain a typographical error. A new corrected Abstract is provided herewith. Withdrawal of the objection to the Abstract is solicited.

In The Specification

The specification stands objected to due to various informalities noted in subheadings 3-10 on page 2 of the pending Office Action. The specification has been amended as kindly suggested by the Examiner, with the exception of the proposed changes in subheadings 7-9. Specifically, the Office Action suggests in subheadings 7-9 that Applicants change "first insulating film 45" to "first insulating film 45." Applicants believe that "first insulating film 45" should be changed to "first etch barrier 45" and have amended the specification accordingly. No new matter has been introduced. Withdrawal of the objection to the Specification is solicited.

Rejections Under 35 U.S.C. §112, ¶2

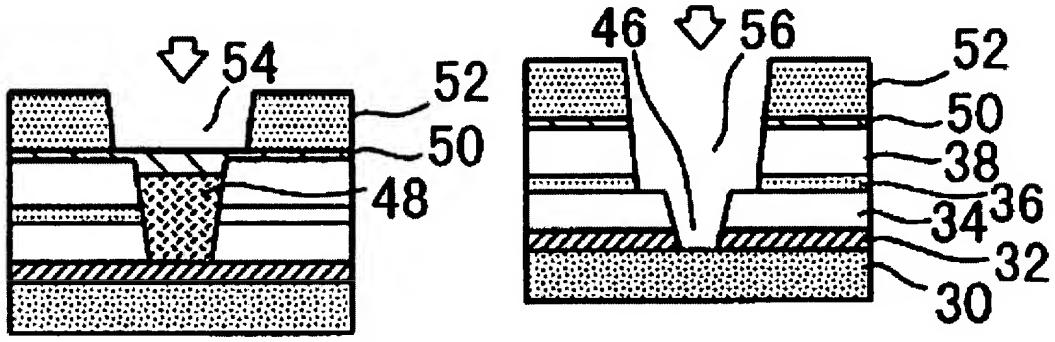
Claims 1-7 stand rejected under 35 U.S.C. §112, ¶2 as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Specifically, claim 1 stands rejected for reciting "interlayer insulating" which the Office Action states should be replaced with "etch barrier." Additionally, the Office Action states "a" should be inserted after "metal lines of" in line 1 of claim 1. Claim 1 has been amended accordingly. Withdrawal of the rejection under 35 U.S.C. §112, ¶2 is solicited.

Rejections Under 35 U.S.C. §102

Claims 1-4 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,251,774 to Harada ("Harada" hereafter). Claims 1-4 also stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Published Patent Application No. 2002/0192945 to Nagahara ("Nagahara" hereafter). Claims 1-5 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,642,153 to Chang ("Chang" hereafter). Applicants respectfully traverse these rejections for at least the following reasons.

U.S. Patent No. 6,251,774 (Harada)

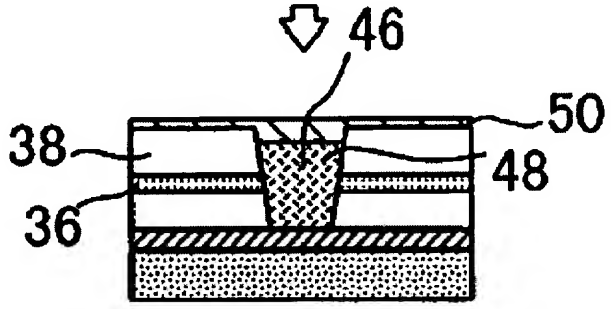
Harada discloses a method of manufacturing a semiconductor device with a wiring element having a dual damascene structure formed on a lower wiring layer (col. 1, lines 7-11). In particular, Harada forms a first silicon nitride film 32, a first silicon oxide film 34, a second silicon nitride film 36, and a second silicon oxide film 38 in this sequence on the lower wiring layer 30 (col. 5, lines 22-28). These layers go through a developing process, with a wiring trench 56 eventually being formed in the semiconductor wafer as shown in Figs. 1E and 1F (col. 6, lines 44-46). Figs. 1E and 1.F are reproduced below for the Examiner's convenience:



As shown above, Harada removes the exposed portion of the first silicon nitride film 32 *after* the opening 54 (part of the upper wiring layer) is formed (col. 6, lines 49-53). This is contrary to the presently claimed invention, which removes the exposed portion of the first etch barrier film to

expose the lower metal line *prior* to forming the upper metal line region. Thus, Harada fails to anticipate the presently claimed invention for at least this reason.

Harada also fails to disclose or suggest forming a photoresist film on the *entire surface* as presently claimed. Rather, in Harada the photoresist film 48 is not formed on the entire surface; the photoresist film 48 in Harada is formed only in the via hole 46 (col. 9, lines 4-9) as shown in Fig. 1D. Fig. 1D is reproduced below for the Examiner's convenience.



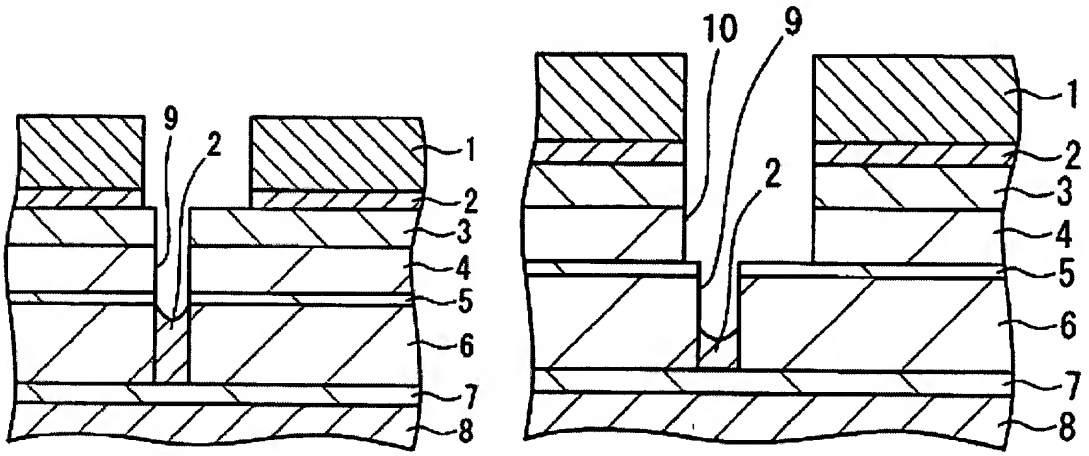
Moreover, Harada fails to disclose or suggest subjecting the *claimed* photoresist film to an exposure and development process to form a photoresist film pattern. Rather, in Harada a second Bottom Anti-reflective Coating (BARC) 50 is applied over the second silicon oxide film 38 and the thus-hardened photoresist film 48 (col. 6, lines 27-29). Then, a *second photoresist film 52* is formed on the second BARC 50 through use of photolithography (col. 6, line 30-34). At the time of patterning the *second photoresist film 52* (i.e., *not* the photoresist film 48), the *second photoresist film 52* is irradiated with light while a mask is superimposed thereon (col. 6, lines 34-36). Thus, Harada fails to anticipate the presently claimed invention for these additional reasons.

Withdrawal of the rejection under 35 U.S.C. §102(b) over Harada is solicited.

U.S. Published Patent Application No. 2002/0192945 (Nagahara)

Nagahara also fails to disclose or suggest removing the exposed portion of the first etch barrier film to expose the lower metal line *prior* to forming the upper metal line region as presently claimed. Rather, Nagahara discloses a method of forming a wiring structure by using a via-first dual

damascene method in which a development rate of a photo resist film is optimized (paragraph [0004]). In Nagahara, an etching stopper film 7 is formed on a lower wiring layer 8 (paragraph [0079]). These layers go through a developing process with a wiring trench 10 eventually being formed as shown in Figs. 2C and 3A (paragraph [0086]). Figs. 2C and 3A are reproduced below for the Examiner's convenience.



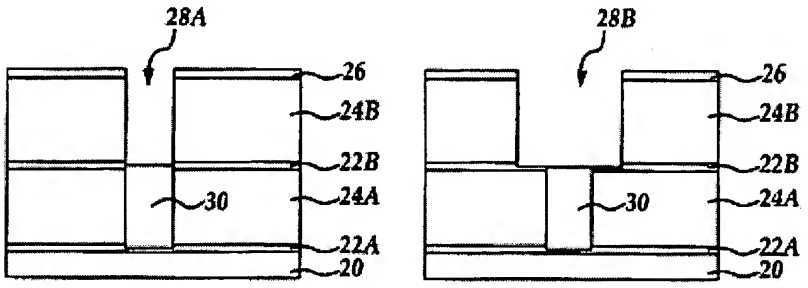
As shown above, Nagahara removes the exposed portion of the etching stopper film 7 *after* the trench 10 (part of the upper wiring layer) is formed (paragraph [0087]). This is contrary to the presently claimed invention, which removes the exposed portion of the first etch barrier film to expose the lower metal line *prior* to forming the upper metal line region. Thus, Nagahara fails to anticipate the presently claimed invention for at least this reason.

In addition, Nagahara fails to disclose or suggest forming a photoresist film on the *entire* surface and subjecting the photoresist film to an exposure and development processes to form a photoresist film pattern as presently claimed. Rather, in Nagahara bottom anti-reflective coating 2 (i.e., *not* the photoresist film 1) is applied within the via hole 9 (paragraph [0082]). Thus Nagahara fails to anticipate the presently claimed invention for this additional reason.

Withdrawal of the rejection under 35 U.S.C. §102(e) over Nagahara is solicited.

U.S. Patent No. 6,642,153 to Chang

Chang also fails to disclose or suggest removing the exposed portion of the first etch barrier film to expose the lower metal line *prior* to forming the upper metal line region as presently claimed. Chang discloses a method for preventing or avoiding the presence of unetched polymer residues including photoresist remaining in anisotropically etched semiconductor features including trench line features formed in a dual damascene process (col. 1, lines 8-13). In particular, Chang forms an etching stop layer 22A on a conductive region 20 (col. 4, lines 31-38). The semiconductor undergoes further processes to form a trench opening 28B as shown in Figures 2C and 2D. Figures 2C and 2D are reproduced below for the Examiner's convenience.



As shown above, Chang removes the exposed portion of the etching stopper layer 22A *after* the trench opening 28B (part of the upper wiring layer) is formed (col. 6, lines 49-53). This is contrary to the presently claimed invention, which removes the exposed portion of the first etch barrier film to expose the lower metal line *prior* to forming the upper metal line region. Thus, Chang fails to anticipate the presently claimed invention for at least this reason.

Moreover, Chang fails to disclose or suggest use of the photoresist film pattern as a mask in the etching process of the trench opening 28B as presently claimed. Thus, Chang fails to anticipate the presently claimed invention for this additional reason.

Withdrawal of the rejection under 35 U.S.C. §102(e) over Chang is solicited.

Rejections Under 35 U.S.C. §103(a)

Claims 5-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Harada in view of Chang, further in view of U.S. Patent No. 6,521,524 to Wang ("Wang" hereafter). Claims 5-7 also stand rejected under 35 U.S.C. §103(a) as being unpatentable over Nagahara in view of Chang, further in view of Wang. Claims 6 and 7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chang in view of Wang.

Claims 5-7 are dependent upon claim 1, and believed to be allowable for at least the aforementioned reasons with respect to claim 1.

Withdrawal of the rejections under 35 U.S.C. §103(a) is solicited.

Conclusion

In view of the above amendments and remarks, Applicants respectfully request that all objections and rejections be withdrawn and that a notice of allowance be forthcoming. The Examiner is invited to contact the undersigned for any reason related to the advancement of this case. The Commissioner is authorized to credit any over payment or charge any deficient to deposit account number 08-1641.

Respectfully submitted,

HELLER EHRMAN WHITE & McAULIFFE LLP

Date: November 3, 2004

By: _____
John P. Isacson
Registration No. 33715

Address all correspondence to:
HELLER EHRMAN WHITE & McAULIFFE LLP
1666 K Street, NW
Suite 300
Washington, D.C. 20006
Telephone: 202-912-2000
Facsimile: 202-912-2020
Customer Number: 26633